

The distribution of the ferns and fern allies found in Indiana

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Butler University
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Edited by

Ray C. Friesner

The *Butler University Botanical Studies* journal was published by the Botany Department of Butler University, Indianapolis, Indiana, from 1929 to 1964. The scientific journal featured original papers primarily on plant ecology, taxonomy, and microbiology. The papers contain valuable historical studies, especially floristic surveys that document Indiana's vegetation in past decades. Authors were Butler faculty, current and former master's degree students and undergraduates, and other Indiana botanists. The journal was started by Stanley Cain, noted conservation biologist, and edited through most of its years of production by Ray C. Friesner, Butler's first botanist and founder of the department in 1919. The journal was distributed to learned societies and libraries through exchange.

During the years of the journal's publication, the Butler University Botany Department had an active program of research and student training. 201 bachelor's degrees and 75 master's degrees in Botany were conferred during this period. Thirty-five of these graduates went on to earn doctorates at other institutions.

The Botany Department attracted many notable faculty members and students. Distinguished faculty, in addition to Cain and Friesner, included John E. Potzger, a forest ecologist and palynologist, Willard Nelson Clute, co-founder of the American Fern Society, Marion T. Hall, former director of the Morton Arboretum, C. Mervin Palmer, Rex Webster, and John Pelton. Some of the former undergraduate and master's students who made active contributions to the fields of botany and ecology include Dwight W. Billings, Fay Kenoyer Daily, William A. Daily, Rexford Daudenmire, Francis Hueber, Frank McCormick, Scott McCoy, Robert Petty, Potzger, Helene Starcs, and Theodore Sperry. Cain, Daudenmire, Potzger, and Billings served as Presidents of the Ecological Society of America.

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THE DISTRIBUTION OF THE FERNS AND FERN ALLIES FOUND IN INDIANA¹

By SARAH CLEVENGER

The list of Pteridophyta found in Indiana was compiled from the "Flora of Indiana," by Charles C. Deam (3) and the yearly supplementary distribution records prepared by the State Flora Committee of the Indiana Academy of Science (4-11). The publications give the state distribution by counties. For data concerning the national distribution and various state floras, manuals of wider scope and periodical literature were used. The national distribution of the Indiana ferns and fern allies was mapped as accurately as possible, and from these maps the determination of intraneous and extraneous species was made.

Deam (3) recognizes six floral areas in Indiana (figure 1). They are: the Lakes area, the Tipton Till plain, the Illinoian Drift area, the Prairie area, the Lower Wabash Valley area, and the Unglaciated area. The limits of these areas are determined by physiographic features which have been described by him and each has a characteristic flora.

INDIANA DISTRIBUTION

The range of a species in the state was plotted by counties from data given by Deam in his Flora of Indiana (3) and from additional plant distribution records (4-11) prepared by the State Flora Committee of the Indiana Academy of Science and published annually. From these additional records, four taxonomic entities have been added to the list of Indiana Pteridophyta as it originally appeared in the "Flora of Indiana."

Benton County is the only county which is entirely included in the prairie area and it was used as an index in determining whether or not a species was found in the prairie area. The ferns and fern allies listed by Peattie (18), Lyon (15), and Tryon (20) were recorded

¹ A portion of a thesis submitted in partial fulfillment of the requirements for the Master of Science degree in the Division of Graduate Instruction, Butler University.

as being found in the Dunes area. For the Lower Wabash Valley area, the pteridophyta listed by Schneck (19) were considered to be the only species found in this area. The other areas were more easily delimited.

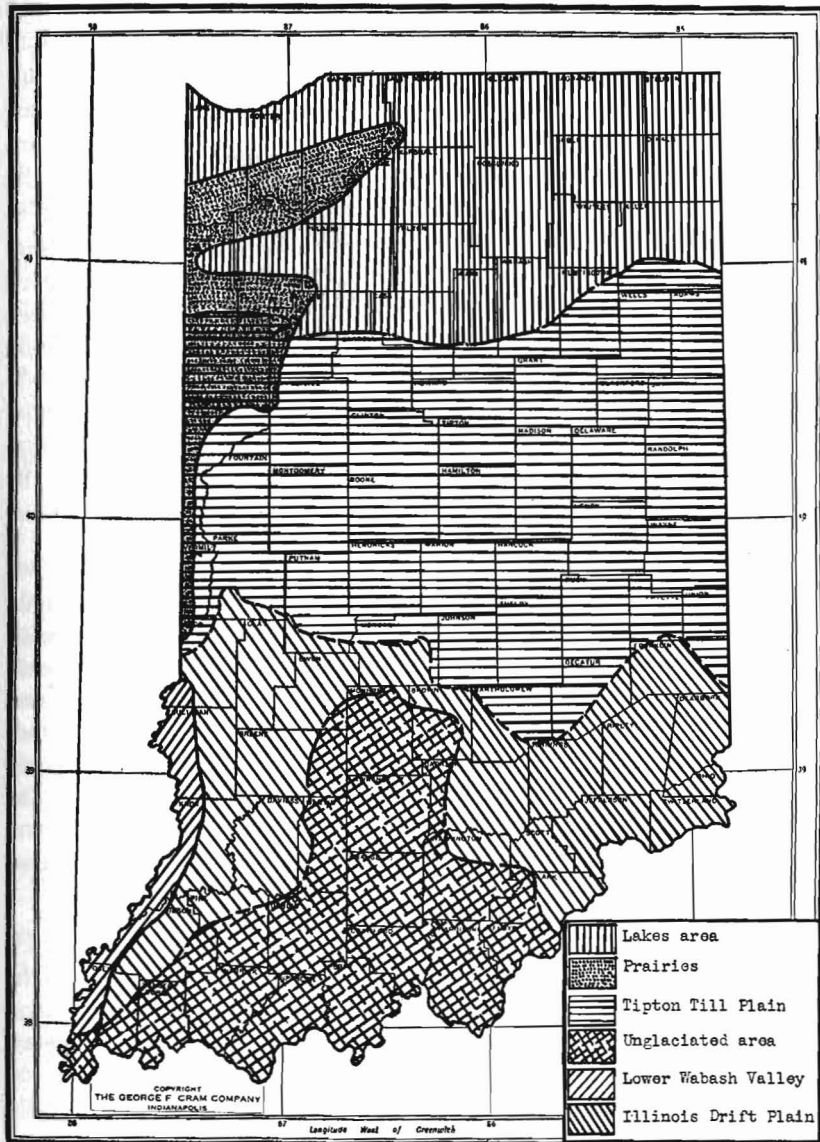
TABLE I
Tabulation of Pteridophyta Found in Indiana

	Genera	Species	Varieties	Forms	Hybrids	Totals
Ophioglossaceae	2	6	3	1	0	10
Osmundaceae	1	2	1	3	0	6
Polypodiaceae	16	30	9	5	5	49
Salviniaceae	1	1	0	0	0	1
Equisetaceae	1	8	0	0	0	8
Lycopodiaceae	1	5	1	0	0	6
Selaginellaceae	1	2	0	0	0	2
Isoetaceae	1	1	0	0	0	1
Totals	24	54	15	10	5	84

The Indiana Pteridophyta represents 8 families, 24 genera, 54 species, 15 varieties, 10 forms, and 5 hybrids (table I). Of these 84 taxonomic entities, 41 are recorded in less than 10 counties and 24 have been found in only one or two counties. Only 14 are found in over 40 counties; no one species is on record from every county, though it is almost certain that a number of species actually do occur in every county in the state.

Cowles (1) states that the flora of the region is composed of two elements. One element consists of those species that are found in the region and in all directions from that region and are termed *intraneous* species. The other element is made up of three groups, (1) *extraneous* species which are found in the region, but are not found in all directions from the region, (2) *disjunct* species which are found in isolated colonies outside their continuous range, and (3) *endemic* species which are found only in that region. No pteridophyte species belonging to the latter two groups are known in Indiana.

Forty-nine species were found to be intraneous in Indiana. Of these intraneous species, *Adiantum pedatum*, *Equisetum arvense*, *E. prealtum*, *Dryopteris noveboracensis*, *Botrychium dissectum* var. *obliquum*, *B. virginianum*, and *Polystichum acrostichoides* are typical, being found throughout the state.



Indiana, by virtue of its geographical location, is often on the northern range limits of southern species and on the southern range limits of northern species (Friesner, 13). The eastern and western range limits are not so clear. Thirty-one of the Pteridophyta found in Indiana are extraneous species. Elements of the eastern or appalachian flora, such as *Pellaea glabella*, *Lycopodium selago* var. *patens*, and *Isoetes engelmannii*, enter Indiana in much the same manner as the southern elements and are found in the eastern lobe of the Illinoian drift area and in the Unglaciated area. A few, such as *Woodwardia virginica*, *Lycopodium tristachyum*, and *Lycopodium obscurum*, are eastern and northeastern species. The almost total lack of ferns in the Great Plains region eliminates the necessity of considering the western element, for only two Pteridophyta, *Equisetum kansanum* and *E. laevigatum*, found in Indiana, have predominantly western distributions, and their eastern range limit is found in Ohio. The northern group may be typified by *Botrychium simplex*, *Dryopteris bootii*, and *Equisetum fluviatile*; and the southern group by *Cheilanthes lanosa* and *Polypodium polypodioides* var. *michauxianum*.

Some species which must be classed as intraneous because they occur in similar habitats in all directions outside the state, have only a limited distribution within the state. In such cases absence of suitable habitats, rather than wider range of distribution is the controlling factor. Examples are found in *Dennstaedtia punctilobula* and *Asplenium trichomanes*. Each of these species has its wider distribution surrounding Indiana on all sides. The former has a known occurrence in Indiana in only four counties, three of them in the Unglaciated area and one in the Tipton till plain. The latter is found in 8 counties, 5 of them in the Unglaciated area and 3 in the Tipton till plain.

The distribution according to floral areas is given in Table II. A summary of Table II is found in table III. As may be seen in the tables, the Lakes area and the Unglaciated area contain the greatest number of entities with 74% and 67% respectively, of the total number. This is probably due to the great variety of habitats found in both areas. The Tipton till plain ranks third with 55 species or 65%. It might be expected that this region, which is the largest of the floral areas, would have the greatest number of species, but due to extensive cultivation of the land, the disappearance of the forests, the draining

of the swamps, and the grazing of hillsides, many fern habitats have been destroyed. The Illinoian drift area is next with 56%, while the Prairie area and the Lower Wabash Valley area have only 8% and 28%, respectively. Only 4 species are found in all of the floral areas. They are: *Onoclea sensibilis*, *Pteridium aquilinum* v. *latiusculum*, *Equisetum arvense*, and *E. prealtum*.

Not enough data were available to determine the national range of 9 of the 84 entities of Pteridophyta found in Indiana. Three-fifths of the plants whose ranges were determined are found in central United States and are intraneous to Indiana. The remaining two-fifths reach their range limits within Indiana. Of the extraneous entities, 15 or 55% are found in the Unglaciated area and a similar number in the Lakes area. The Illinoian till plain is next in order with 10 and the Tipton till plain follows with 9 entities. The Tipton till plain contains the largest number of intraneous species, followed closely by the Lakes area, the Illinoian drift plain, and the Unglaciated area.

UNITED STATES DISTRIBUTION

Of the 75 species, varieties, and forms whose national distributions were mapped, 55 were limited to the central and eastern portion of the country. Only 13 were found west of the Rocky Mountains. Many of the eastern ferns find their range limit in the central lowlands. Over 80% of the entities are found in the Appalachian Highlands and the Interior Low Plateaus. The Interior Highlands contain 76% of the entities while the Central Plains and the Laurentian Uplands have 57% and 59% respectively. The Great Plains (with the exception of the Black Hills of South Dakota), the Wyoming Basin, and the Southern Rocky Mountains each has less than 10% of the Indiana species within their boundaries. The percentages rise to 13 for the Intermontane Plateaus and to 15.5 for the Pacific Coast states.

The following Indiana species are found in the Pacific Coast states: *Ophioglossum vulgatum*, *Botrychium virginianum*, *Cystopteris fragilis*, *Asplenium trichomanes*, *Equisetum arvense*, *E. fluviatile*, *E. kansanum*, *E. variegatum*, *E. laevigatum*, *E. prealtum*, *Lycopodium inundatum*, *L. obscurum*, and *L. selago* var. *patens*. In addition, a few eastern species are represented in the Pacific Coast states by closely related varieties. For instance, *Adiantum pedatum* var.

aleuticum and *Pteridium aquilinum* var. *lanuginosum* are found in northern North America and along the Pacific coast, while their eastern counterparts, *Adiantum pedatum* and *Pteridium aquilinum* var. *latiusculum* have a more southern range. Hanna (14) states that intergrades between *Pteridium aquilinum* var. *latiusculum* and *P. aquilinum* var. *lanuginosum* are found in Wyoming.

Many of the eastern species find their western limits in the states bordering on the Mississippi River and then are present in the Black Hills of South Dakota. This area has a unique flora, for plants are found here which are not found in the neighboring regions (McIntosh, 16).

Table II lists the 27 extraneous species and gives the compass directions of their distribution outside Indiana. Twenty-five or 92% of these extraneous species are found northeast of Indiana or in the northern portion of the Appalachian Highlands. Almost 70% are found east and 61% southeast of Indiana. These three directions include the Appalachian Highlands which contain 84% of the Indiana Pteridophyta. The southwest, south, and north directions have percentages of 58, 55, and 52, respectively. The weakest affinity is to the west and northwest. It would be expected that the affinity to the west would be weaker than it turns out to be; the higher affinity is due to the fact that a few of the eastern species find their western limits in Illinois and, though they are found west of Indiana, they are not truly western plants. Thus it is seen from the national distribution of the 75 entities of Indiana Pteridophyta as well as from the distribution of the extraneous group that the strongest affinity in distribution is to the Appalachian Highlands or in the directions of northeast, east and southeast.

SUMMARY AND CONCLUSIONS

1. There are 84 species, varieties, and forms of Pteridophyta found growing outside of cultivation in Indiana. Of these, 24 may be considered rare since they are found in only one or two counties.

2. Four species or 5% of the total number are found in all of the floral areas. The Lakes area contains the greatest number of species, having 74% of the total, with other areas containing the following percentages: Unglaciaded area, 67%; Tipton till plain, 65%; Illinoian Drift area, 56%; Prairie area, 8%; Lower Wabash Valley area, 28%.

3. Forty-seven species are intraneous and occur in the following percentages: Lakes area, 83%; Tipton till plain, 85%; Illinoian Drift area, 75%; Unglaciated area, 79%; Lower Wabash Valley area, 45%; Prairie area, 14%; all areas, 8%.

4. Twenty-seven species are extraneous, being on the limit of their ranges. The greatest number, 15 or 55%, of extraneous species is found in the Unglaciated area and the Lakes area. Other areas with their percentages of extraneous species are as follows: Tipton till plain, 33%; Illinoian Drift area, 37%; Prairie area, 7%; Lower Wabash Valley area, 7%.

5. In considering the general distribution of the Pteridophyta found in Indiana, the greatest density of the species occurs in the Appalachian Highlands in which 84% of the species were recognized. The relative density of the Indiana Pteridophyta in the other physiographic divisions of the United States are as follows: the Interior Low Plateaus, 81%; Interior Highlands, 76%; Laurentian Uplands, 59%; Interior Plains, 48%; Atlantic Plains, 26%; Intermontane Plateaus, 11%; Pacific Mountain System, 8%; Rocky Mountain System, 7%.

6. Of the extraneous species, 92% have a range which extends in a northeast direction from Indiana. The percentages of the extraneous species which have their ranges in the other compass directions are as follows:—east, 68; south, 55; southwest, 58; west, 42; northwest, 42; north, 52.

ACKNOWLEDGMENT

The writer wishes to express appreciation to Dr. Ray C. Friesner who suggested this topic and under whose direction the work was done.

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TABLE II

The Distribution of Pteridophyta within the Floral Areas of Indiana

P, Prairie Area; L, Lakes Area; T, Tipton Till Plain; I, Illinoian Drift Area; U, Unglaciaded Area; W, Lower Wabash Valley Area; E, SE, S, SW, W, NW, N, E, Compass directions in which distributions of extraneous species occur outside Indiana.

Species	P	L	T	I	U	W	Directions
OPHIOGLOSSACEAE							
<i>Ophioglossum vulgatum</i>		X	X	X	X	X	(Intr.)
<i>O. vulgatum</i> f. <i>pseudopodium</i>		X					(Intr.)
<i>O. engelmanni</i>					X		SE, S, SW
<i>Botrychium simplex</i>		X					NW, N, NE
<i>B. multifidum</i> var. <i>silvaifolium</i>		X					NW, N, NE
<i>B. dissectum</i>		X	X	X	X	X	(Intr.)
<i>B. dissectum</i> f. <i>elongatum</i> (15)		X	X				W, NW, N, NE
<i>B. dissectum</i> var. <i>obliquum</i>		X	X	X	X	X	(Intr.)
<i>B. dissectum</i> var. <i>tenuifolium</i>					X		SE, S, SW
<i>B. dissectum</i> var. <i>oneidense</i>		X	X				W, NW, NE, E
<i>B. virginianum</i>		X	X	X	X	X	(Intr.)
OSMUNDACEAE							
<i>Osmunda regalis</i> var. <i>spectabilis</i>		X	X	X	X	X	(Intr.)
<i>O. claytonia</i>		X	X	X	X		(Intr.)
<i>O. cinnamomea</i>		X	X	X	X	X	(Intr.)
<i>O. cinnamomea</i> f. <i>auriculata</i>		X					(Intr.)
<i>O. cinnamomea</i> f. <i>frondosa</i>		X					(Intr.)
<i>O. cinnamomea</i> f. <i>incisa</i>		X					(Intr.)
POLYPODIACEAE							
<i>Woodsia obtusa</i>		X	X	X	X	X	(Intr.)
<i>Cystopteris bulbifera</i>		X	X	X	X	X	(Intr.)
<i>C. fragilis</i>		X	X	X	X		(Intr.)
<i>C. fragilis</i> var. <i>protrusa</i>			X	X		X	(Intr.)
<i>C. fragilis</i> var. <i>mackayii</i> (15)			X				W, NW, N, NE, E
<i>Pteretis pensylvanica</i>		X	X	X	X		(Intr.)
<i>P. pensylvanica</i> f. <i>pubescens</i>		X	X				(Intr.)
<i>Onoclea sensibilis</i>	X	X	X	X	X	X	(Intr.)
<i>Dryopteris hexagonoptera</i>		X	X	X	X		(Intr.)
<i>D. noveboracensis</i>		X	X	X	X		(Intr.)
<i>D. thelypteris</i> var. <i>pubescens</i>	X	X	X	X	X		(Intr.)
<i>D. marginalis</i>		X	X	X	X		(Intr.)
<i>D. goldiana</i>		X	X	X	X		(Intr.)
<i>D. goldiana</i> X <i>marginalis</i>					X		—
<i>D. cristata</i>		X	X		X		(Intr.)
<i>D. cristata</i> var. <i>clintonia</i>		X					—
<i>D. cristata</i> X <i>spinulosa</i>		X					—
<i>D. spinulosa</i>		X	X	X	X		(Intr.)

TABLE II—(Continued)

The Distribution of Pteridophyta within the Floral Areas of Indiana

P, Prairie Area; L, Lakes Area; T, Tipton Till Plain; I, Illinoian Drift Area; U, Unglaciaded Area; W, Lower Wabash Valley Area; E, SE, S, SW, W, NW, N, E, Compass directions in which distributions of extraneous species occur outside Indiana.

Species	P	L	T	I	U	W	Directions
<i>D. spinulosa</i> var. <i>fructuosa</i>		X					—
<i>D. intermedia</i>		X	X		X		(Intr.)
<i>D. boottii</i>		X	X				(Intr.)
<i>D. intermedia</i> X <i>marginalis</i> (15)			X				—
<i>Polystichum acrostichoides</i>		X	X	X	X	X	(Intr.)
<i>P. acrostichoides</i> f. <i>incisum</i>				X	X		(Intr.)
<i>P. acrostichoides</i> I. <i>crispum</i>		X					(Intr.)
<i>Dennstaedtia punctilobula</i>			X		X	X	(Intr.)
<i>Athyrium pycnocarpon</i>		X	X	X	X	X	(Intr.)
<i>A. thelypteroides</i>		X	X	X	X		(Intr.)
<i>A. asplenoides</i>		X	X	X	X	X	E, SE, S, SW, W, NE
<i>A. angustum</i>		X	X	X	X	X	(Intr.)
<i>A. angustum</i> var. <i>elatius</i>		X	X	X	X		(Intr.)
<i>A. angustum</i> var. <i>rubellum</i>		X	X	X	X	X	(Intr.)
<i>Camptosorum rhizophyllum</i>			X	X	X	X	(Intr.)
<i>C. rhizophyllum</i> f. <i>auriculatus</i>					X		
<i>Asplenium cryptolepis</i>				X	X		NE, E, SE, S, SW
<i>A. pinnatifidum</i>			X	X	X		NE, E, SE, S, SW
<i>A. platyneuron</i>	X	X	X	X	X	X	(Intr.)
<i>A. platyneuron</i> f. <i>serratum</i>					X		NE, E, SE, S, SW
<i>A. trichomanes</i>			X		X		(Intr.)
<i>Asplenosorus ebenoides</i>				X	X		NE, E, SE, S, SW
<i>Woodwardia virginica</i>	X						N, NE, E, SE, S
<i>Pellaea atropurpurea</i>			X	X	X		(Intr.)
<i>P. glabella</i>			X	X	X		NE, E, SE, S, SW, W
<i>Cheilanthes lanosa</i>					X		NE, E, SE, S, SW
<i>Adiantum pedatum</i>	X	X	X	X	X	X	(Intr.)
<i>Pteridium aquilinum</i> v. <i>latiusculum</i>	X	X	X	X	X	X	(Intr.)
<i>P. aquilinum</i> var. <i>pseudocaudatum</i>			X	X			NE, E, SE, S, SW
<i>Polypodium virginianum</i>	X	X	X	X			(Intr.)
<i>P. polypodioides</i> v. <i>michauxianum</i>			X	X	X		E, SE, S, SW
SALVINIACEAE							
<i>Azolla caroliniana</i>		X	X	X		X	(Intr.)
EQUISETACEAE							
<i>Equisetum arvense</i>	X	X	X	X	X	X	(Intr.)
<i>E. trachyodon</i>		X					—
<i>E. variegatus</i>		X					W, NW, N, NE
<i>E. nelsoni</i>		X	X				NW, N

TABLE II—(Continued)

The Distribution of Pteridophyta within the Floral Areas of Indiana

P, Prairie Area; L, Lakes Area; T, Tipton Till Plain; I, Illinoian Drift Area; U, Unglaciaded Area; W, Lower Wabash Valley Area; E, SE, S, SW, W, NW, N, E, Compass directions in which distributions of extraneous species occur outside Indiana.

Species	P	L	T	I	U	W	Directions
<i>E. prealtum</i>	X	X	X	X	X	X	(Intr.)
<i>L. laevigatum</i>	X	X	X	X	X		SW, W, NW, N, NE
<i>E. kansanum</i>	X	X	X	X			SW, W, N, NE
<i>E. fluviatile</i>		X	X				W, NW, N, NE
LYCOPIDIACEAE							
<i>Lycopodium selago</i> var. <i>patens</i>					X		NE, E, SE, S, SW, W
<i>L. lucidulum</i>		X	X	X	X		(Intr.)
<i>L. inundatum</i>		X					W, NW, N, NE, E
<i>L. obscurum</i>		X					NW, N, NE, E, SE
<i>L. flabelliforme</i>		X	X	X	X		(Intr.)
<i>L. tristachyum</i> (19)		X					NW, N, NE, E, SE
SELAGINELLACEAE							
<i>Selaginella apoda</i>		X	X	X	X		(Intr.)
<i>S. rupestris</i>		X	X				(Intr.)
ISOETACEAE							
<i>Isoetes engelmanni</i>						X	NE, E, SE, S, SW

TABLE III

The Distribution of Intraneous and Extraneous Species in the Floral Areas of Indiana

Botanical Areas	<i>Intraneous</i>		<i>Extraneous</i>		<i>Totals</i>	
	No. of Species	Percent	No. of Species	Percent	No. of Species	Percent
Lakes Area	41	83	15	55	62	74
Prairie Area	7	14	2	7	7	8
Tipton Till Plain	42	85	9	33	55	65
Illinoian Drift Area	37	75	10	37	47	56
Unglaciaded Area	39	79	15	55	56	67
Wabash Valley Area	22	45	2	7	24	28
In all areas	4	8	0	0	4	5
Entire state	49	100	27	100	84	100